

IN THE CLAIMS

Claim 1 (currently amended) A process for the preparation of a pigment dispersion which comprises

a) a pigment surface treatment step of introducing at least one hydrophilic dispersibility-providing group onto the surface of a pigment directly and/or with the interposition of a polyvalent group to form a surface treated pigment that is self-dispersible in water and that comprises said at least one hydrophilic dispersibility-providing group in an amount of not lower than 10×10^{-6} equivalent per gram of particulate pigment,

b) a dispersion step of dispersing a surface-treated pigment obtained at said surface treatment step in an aqueous medium, wherein said dispersion step involves the dispersion of said surface-treated pigment in admixture with a wetting agent and water, wherein the wetting agent is selected from the group consisting of acetylene glycols, acetylene alcohols, glycol ethers, 1,2-(C₄-C₁₀ alkyl) diols, 1,3-(C₄-C₁₀ alkyl) diols, 1,5-(C₄-C₁₀ alkyl) diols, and 1,6-(C₄-C₁₀ alkyl)diols, and alkylene glycols and is present in an amount that enhances a dispersion efficiency of particles of the surface-treated pigment in water, and

(c) adding a resin for providing dispersibility and/or fixability during and/or after said dispersion step to form said pigment dispersion, wherein the pigment dispersion has a liquid component comprising polyvalent metal ions in a total amount of not more than 600 ppm, wherein the dispersion step results in a dispersion having a pigment concentration of from about 5 to 50% by weight.

Claim 2 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein the surface tension at 20°C of the mixture at said dispersion step is not

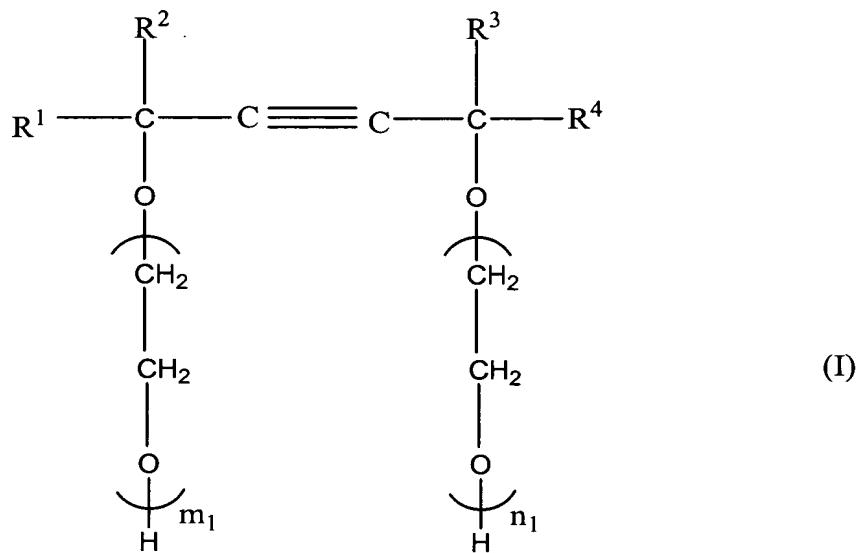
higher than 40 mN/m.

Claims 3 and 4 (canceled)

5. (Currently amended) The process for the preparation of pigment dispersion according to Claim [[4]]1, wherein the wetting agent further comprises the wetting agent comprises acetylene glycols and/or acetylene alcohols in an amount of from not lower than 1/50 of to twice the amount of said pigment by weight.

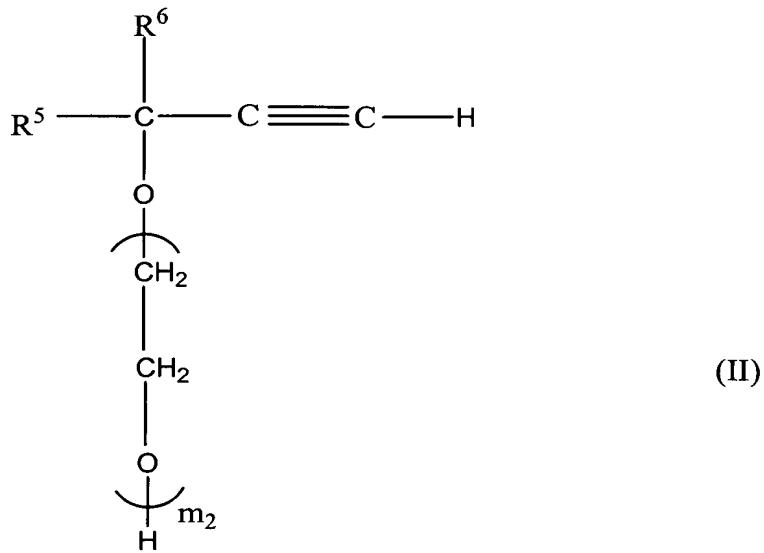
Claim 6 (Currently amended) The process for the preparation of a pigment dispersion according to Claim [[4]] 5, wherein said acetylene glycols and acetylene alcohols are compounds represented by the following general formulae (I) and (II), respectively:

[ka-1]



wherein R¹, R², R³ and R⁴ each independently represent an alkyl group; and the sum of m₁ and n₁ is from 0 to 30; and

[ka-2]



wherein R⁵ and R⁶ each independently represent an alkyl group; and m₂ is from 0 to 30.

Claim 7 (Previously presented) The process for the preparation of a pigment dispersion according to Claim 1, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step comprises at least one selected from the group consisting of functional groups represented by the following general formulae and salts thereof -OM, -COOM, -CO-, -SO₃M, -SO₂M, -SO₂NH₂, -RSO₂M, -PO₃HM, -PO₃M₂, -SO₂NHCOR, -NH₃, and -NR₃ in which M represents a hydrogen atom, alkaline metal, ammonium or organic ammonium; and R represents a C₁₋₁₂ alkyl group, a phenyl group which may have a substituent or a naphthyl group which may have a substituent.

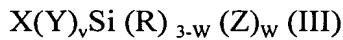
Claim 8 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step is a sulfur-containing dispersibility-

providing group.

Claim 9 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein the amount of said resin to be added is from not lower than 1/10 of to three times the amount of said pigment by weight.

Claim 10 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin comprises an alkali-soluble resin and/or a vinyl polymer obtained by the copolymerization of (a) one or more selected from the group consisting of silicon macromer represented by the following general formula (III) and acrylamide or methacrylamide-based monomer (excluding said monomer having salt-producing groups), (b) a polymerizable unsaturated monomer having a salt producing group and (c) a monomer copolymerizable with these monomers in the presence of a radical polymerization initiator:

[ka-3]



wherein X represents a polymerizable unsaturated group; Y represents a divalent connecting group; R represents a hydrogen atom, a lower alkyl group, an aryl group or an alkoxy group, with the proviso that a plurality of R's may be the same or different; Z represents a monovalent siloxane polymer moiety having a number-average molecular weight of at least about 500; v represents 0 or 1; and w represents an integer of from 1 to 3.

Claim 11 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said resin exhibits a glass transition temperature of not lower than 50°C.

Claim 12 (original) The process for the preparation of a pigment dispersion according to
Claim 1, wherein said resin has a weight-average molecular weight of from 1,600 to 50,000.

Claim 13 (original) The process for the preparation of a pigment dispersion according to
Claim 1, wherein said resin exhibits an acid value of from 10 to 250.

Claim 14 (original) The process for the preparation of a pigment dispersion according to
Claim 10, wherein among said resins, the alkali-soluble resin is a styreneacrylic acid
copolymer.

Claim 15 (canceled)

Claim 16 (previously presented) The process for the preparation of a pigment dispersion
according to Claim 1, wherein Si, Ca, Mg, Fe, Cr and Ni ions incorporated in the liquid
component of the pigment dispersion are each not higher than 100 ppm.

Claim 17 (original) The process for the preparation of a pigment dispersion according to
Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at
said surface treatment step comprises a carbon black pigment and/or an organic pigment.

Claim 18 (original) The process for the preparation of a pigment dispersion according to
Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at
said surface treatment step comprises one or more pigments selected from the group
consisting of C.I. pigment red, C.I. pigment yellow, C.I. pigment violet, C.I. pigment blue,
C.I. pigment orange, C.I. pigment green, and C.I. pigment brown.

Claim 19 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of phthalocyanine pigment, quinacridone pigment, condensed azo pigment, isoindolinone pigment, quinophthalone pigment, anthraquinone pigment, benzimidazolone pigment, and perylene pigment.

Claim 20 (original) The process for the preparation of a pigment dispersion according to Claim 1, wherein said surface treatment step involves the introduction of a polymer material onto the surface of a pigment directly and/or with the interposition of a polyvalent group.

Claim 21 (previously presented) A pigment dispersion prepared by the process for the preparation of a pigment dispersion described in Claim 1.

Claim 22 (original) An ink jet recording ink at least comprising the pigment dispersion described in Claim 21.

Claim 23 (original) An ink jet recording method which comprises energizing the ink described in Claim 22 so that it is ejected from a recording head and attached to a recording medium.

Claim 24 (original) The ink jet recording method according to Claim 23, wherein said energy is a dynamic energy.

Claim 25 (original) The ink jet recording method according to Claim 23, wherein said

energy is a heat energy.

Claim 26 (previously presented) A recorded material obtained by the method described in Claim 23.

Claim 27 (previously presented) The process according to claim 1, wherein the wetting agent is present in an amount of from 0.1 to 30% by weight based on the weight of the pigment dispersion in the dispersion step.

Claims 28 and 29 (canceled)

Claim 30 (previously presented) A process for the preparation of a recording liquid comprising the steps of (i) providing a pigment dispersion prepared by the process of claim 1; and

(ii) subsequent to the preparation of said pigment dispersion, mixing the pigment dispersion with at least a solvent to form the recording liquid.

Claim 31 (previously presented) The process as claimed in claim 30, wherein step (ii) comprises mixing the pigment dispersion with at least the solvent, a surfactant and water to form the recording liquid.

Claim 32 (currently amended) The process as claimed in claim 31, wherein the recording liquid has a solid component comprising the surface treated pigment and resin and a liquid component comprising the wetting agent, solvent, surfactant, polyvalent metal ions and water, the solid component of the recording liquid being present in an amount by weight that

is less than an amount by weight of the wetting agent, solvent, surfactant and polyvalent metal ions present ~~substituents other than water~~ in the liquid component of the recording liquid.

Claim 33 (currently amended) The process as claimed in claim 32, wherein the pigment dispersion has (i) a liquid component comprising the wetting agent, water and polyvalent metal ions and (ii) a solid component comprising the surface treated pigment and the resin, said solid component being present in the pigment dispersion in an amount by weight that is greater than a total amount by weight of ~~substituents other than water~~ the wetting agent and polyvalent metal ions present in the liquid component.

Claim 34 (previously presented) The process according to claim 33, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, the polyvalent metal ions and water.

Claim 35 (previously presented) The process according to claim 33, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, a neutralizing agent, the polyvalent metal ions and water.

Claim 36 (previously presented) The process according to claim 1, wherein the resin is added during said dispersion step.

Claim 37 (New) A process for the preparation of a pigment dispersion which comprises:
(a) a pigment surface treatment step of introducing at least one hydrophilic dispersibility-providing group onto the surface of a pigment directly and/or with the interposition of a polyvalent group to form a surface treated pigment that is self-dispersible in

water and that comprises said at least one hydrophilic dispersibility-providing group in an amount of not lower than 10×10^{-6} equivalent per gram of particulate pigment,

(b) a dispersion step of dispersing a surface treated pigment obtained at said surface treatment step in an aqueous medium, wherein said dispersion step involves the dispersion of said surface-treated pigment in admixture with a wetting agent and water wherein the wetting agent is selected from the group consisting of acetylene glycols, acetylene alcohols, glycol ethers and alkylene glycols and is present in an amount that enhances a dispersion efficiency of particles of the surface-treated pigment in water, and

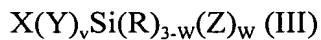
(c) adding a resin for providing dispersibility and/or fixability during and/or after said dispersion step to form said pigment dispersion, wherein the pigment dispersion has a liquid component comprising polyvalent metal ions in a total amount of not more than 600 ppm,

wherein the dispersion step results in a dispersion having a pigment concentration of from about 5 to 50% by weight; and

wherein said resin comprises a vinyl polymer obtained by the copolymerization of (a) one or more selected from the group consisting of silicon macromer represented by the following general formula (III) and acrylamide or methacrylamide-based monomer (excluding said monomer having salt-producing groups),

(b) a polymerizable unsaturated monomer having a salt producing group and (c) a monomer copolymerizable with these monomers in the presence of a radical polymerization initiator:

[ka-3]



wherein X represents a polymerizable unsaturated group; Y represents a divalent connecting group; R represents a hydrogen atom, a lower alkyl group, an aryl group or an alkoxy group, with the proviso that a plurality of R's may be the same or different; Z represents a

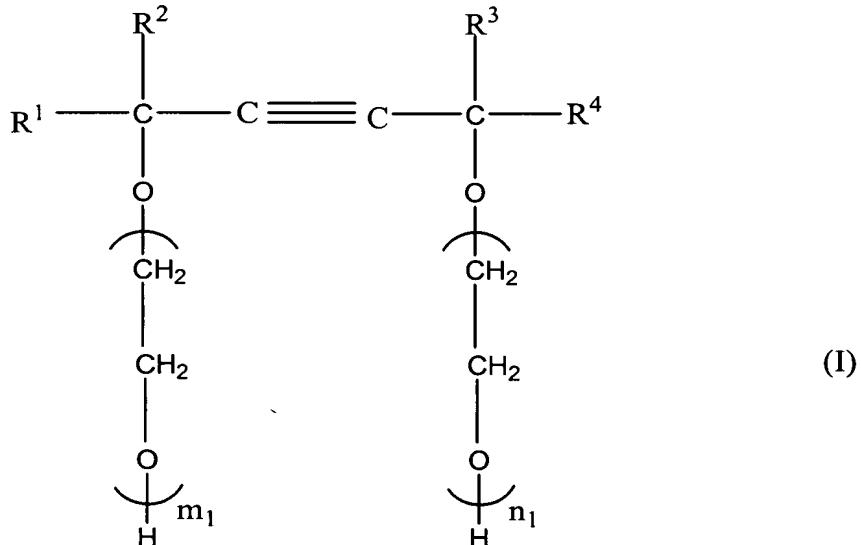
monovalent siloxane polymer moiety having a number-average molecular weight of at least about 500; v represents 0 or 1; and w represents an integer of from 1 to 3.

Claim 38 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein the surface tension at 20°C of the mixture at said dispersion step is not higher than 40 mN/m.

Claim 39 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein the wetting agent comprises acetylene glycols and/or acetylene alcohols in an amount of from not lower than 1/50 of to twice the amount of said pigment by weight.

Claim 40 (New) The process for the preparation of a pigment dispersion according to claim 39, wherein said acetylene glycols and acetylene alcohols are compounds represented by the following general formulae (I) and (II), respectively:

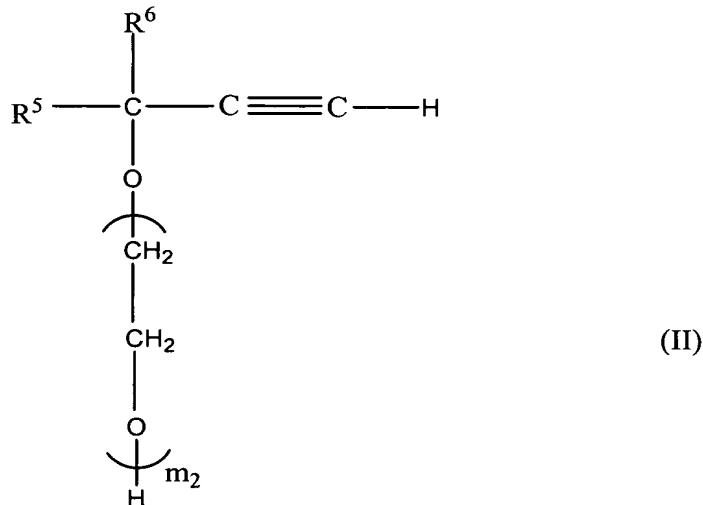
[ka-1]



wherein R¹, R²,

R³ and R⁴ each independently represents an alkyl group; and the sum of m₁ and n₁ is from 0 to 30; and

[ka-2]



wherein R⁵ and R⁶ each independently represents an alkyl group; and m₂ is from 0 to 30.

Claim 41 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step comprises at least one selected from the group consisting of functional groups represented by the following general formulae and salts thereof -OM, -COOM, -CO-, -SO₃M, -SO₂M, -SO₂NH₂, -RSO₂M, -PO₃HM, -PO₃M₂, -SO₂NHCOR, -NH₃, and -NR₃ in which M represents a hydrogen atom, alkaline metal, ammonium or organic ammonium; and R represents a C₁₋₁₂ alkyl group, a phenyl group which may have a substituent or a naphthyl group which may have a substituent.

Claim 42 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said hydrophilic dispersibility-providing group to be introduced onto the surface of a pigment at said surface treatment step is a sulfur-containing dispersibility providing group.

Claim 43 (New) The process for the preparation of a pigment dispersion according to

claim 37, wherein the amount of said resin to be added is from not lower than 1/10 of to three times the amount of said pigment by weight.

Claim 44 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said resin exhibits a glass transition temperature of not lower than 50°C.

Claim 45 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said resin has a weight-average molecular weight of from 1,600 to 50,000.

Claim 46 (new) The process for the preparation of a pigment dispersion according to claim 37, wherein said resin exhibits an acid value of from 10 to 250.

Claim 47 (new) The process for the preparation of a pigment dispersion according to claim 37, wherein Si, Ca, Mg, Fe, Cr and Ni ions incorporated in the liquid component of the pigment dispersion and are not higher than 100 ppm.

Claim 48 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises a carbon black pigment and/or an organic pigment.

Claim 49 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of C.I. pigment red, C.I. pigment yellow, C.I. pigment violet, C.I. pigment blue, C.I. pigment orange, C.I. pigment green, and C.I. pigment brown.

Claim 50 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said pigment for introducing a hydrophilic dispersibility-providing group at said surface treatment step comprises one or more pigments selected from the group consisting of phthalocyanine pigment, quinacridone pigment, condensed azo pigment, isoindolinone pigment, quinophthalone pigment, anthraquinone pigment, benzimidazolone pigment, and perylene pigment.

Claim 51 (New) The process for the preparation of a pigment dispersion according to claim 37, wherein said surface treatment step involves the introduction of a polymer material onto the surface of a pigment directly and/or with the interposition of a polyvalent group.

Claim 52 (New) A pigment dispersion prepared by the process for the preparation of a pigment dispersion according to claim 37.

Claim 53 (New) An ink jet recording ink at least comprising the pigment dispersion according to claim 52.

Claim 54 (New) An ink jet recording method which comprises energizing the ink according to claim 53 so that it is ejected from a recording head and attached to a recording medium.

Claim 55 (New) The ink jet recording method according to claim 54, wherein said energy is a dynamic energy.

Claim 56 (New) The ink jet recording method according to claim 54, wherein said

energy is a heat energy.

Claim 57 (New) A recorded material obtained by the method described in claim 54.

Claim 58 (New) The process according to claim 37, wherein the wetting agent is present in an amount of from 0.1 to 30% by weight based on the weight of the pigment dispersion in the dispersion step.

Claim 59 (New) A process for the preparation of a recording liquid comprising the steps of:

- (i) providing a pigment dispersion prepared by the process of claim 37; and
- (ii) subsequent to the preparation of said pigment dispersion, mixing the pigment dispersion with at least a solvent to form the recording liquid.

Claim 60 (New) The process as claimed in claim 59, wherein step (ii) comprises mixing the pigment dispersion with at least the solvent, a surfactant and water to form the recording liquid.

Claim 61 (New) The process as claimed in claim 60, wherein the recording liquid has a solid component comprising the surface treated pigment and resin and a liquid component comprising the wetting agent, solvent, surfactant, polyvalent metal ions and water, the solid component of the recording liquid being present in an amount by weight of the wetting agent, solvent surfactant and polyvalent metal ions present in the liquid.

Claim 62 (New) The process as claimed in claim 61, wherein the pigment dispersion has (i) a liquid component comprising the wetting agent, water and polyvalent metal ions and (ii) a solid component comprising the surface treated pigment and the resin, said solid component being present in the pigment dispersion in an amount by weight that is greater than a total amount by weight of the wetting agent and polyvalent metal ions present in the liquid component.

Claim 63 (New) The process according to claim 62, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, the polyvalent metal ions and water.

Claim 64 (New) The process according to claim 62, wherein the pigment dispersion consists essentially of the surface treated pigment, the resin, the wetting agent, a neutralizing agent, the polyvalent metal ions and water.

Claim 65 (New) The process according to claim 37, wherein the resin is added during said dispersion step.

Claim 66 (new). A process for the preparation of a recording liquid comprising the steps of:
(i) providing a pigment dispersion prepared by a process comprising
a) a pigment surface treatment step of introducing at least one hydrophilic dispersibility-providing group onto the surface of a pigment directly and/or with the interposition of a polyvalent group to form a surface treated pigment that is self-dispersible in water and that comprises said at least one hydrophilic dispersibility-providing group in an amount of not lower than 10×10^6 equivalent per gram of particulate pigment,

b) a dispersion step of dispersing a surface-treated pigment obtained at said surface treatment step in an aqueous medium, wherein said dispersion step involves the dispersion of said surface-treated pigment in admixture with a wetting agent and water wherein the wetting agent is selected from the group consisting of acetylene glycols, acetylene alcohols, glycol ethers and alkylene glycols and is present in an amount that enhances a dispersion efficiency of particles of the surface-treated pigment in water, and

(c) adding a resin for providing dispersibility and/or fixability during and/or after said dispersion step to form said pigment dispersion, wherein the pigment dispersion has a liquid component comprising polyvalent metal ions in a total amount of not more than 600 ppm, wherein the dispersion step results in a dispersion having a pigment concentration of from about 5 to 50% by weight; and

(ii) subsequent to the preparation of said pigment dispersion, mixing the pigment dispersion with at least a solvent to form the recording liquid, wherein step (ii) comprises mixing the pigment dispersion with at least the solvent, a surfactant and water to form the recording liquid, and wherein the recording liquid has a solid component comprising the surface treated pigment and resin and a liquid component comprising the wetting agent, solvent, surfactant, polyvalent metal ions and water, the solid component of the recording liquid being present in an amount by weight that is less than an amount by weight of the wetting agent, solvent, surfactant and polyvalent metal ions present in the liquid component of the recording liquid.